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Laboratory for monitoring bacterial contamination of space components (NASA).

1. Studies of organisms in industrial clean rooms and manufacturing and assembly areas were augmented by initiation of observations in a horizontal laminar flow clean room. Investigation of airborne microorganisms which settle out onto stainless steel surfaces resulted in isolation of 895 organisms and identification of 887. The results obtained show that the levels of airborne microorganisms which accumulate on stainless steel surfaces do not differ significantly among different classes of conventional clean rooms. There were differences, however, in the types of microorganisms found. In clean room A where no rigorous environmental controls were needed, aerobic sporeforming bacteria, (Bacillus spp.) molds, and actinomycetes were the predominant types which consistently accumulated on surfaces. Few staphylococci, micrococci, and other non-sporeforming bacteria were detected. The reverse situation occurred in clean rooms where rigorous environmental control was required. In clean room B where all personnel wore full protective clothing, booties, and gloves and in clean room C where several laminar flow work benches were employed and air was filtered by ultra high efficiency filters, the predominant types of microorganisms found to accumulate on surfaces were staphylococci, micrococci, Corynebacterium spp. and Brevibacterium spp. Likewise, the predominant types of microorganisms found to accumulate on stainless steel surfaces within two manufacturing and assembly areas (C and D) where no environmental control was needed were sporeformers, molds, and actinomycetes. The levels of contamination in both of these factory areas were 2 to 3 times higher than the levels in the clean rooms.
2. Studies were advanced to determine the death rates of natural occurring microbial contaminants on stainless steel surfaces. In one series of experiments, stainless steel strips that had been exposed to the intramural air of clean room B for 21 weeks were covered with sterile aluminum foil for 3 weeks and then assayed quantitatively and qualitatively. The level of aerobic mesophilic microorganisms decreased by 51 percent. Sporeformers, molds, and actinomycetes were the predominant organisms surviving sterile storage.

In a second series of experiments, stainless steel strips were exposed to a laboratory environment for 3 weeks and then covered. Microbiological assays were performed prior to covering, and at intervals up to 8 weeks after covering. At each assay period microorganisms were isolated and subsequently identified. The results indicate clearly that the total aerobic microbial population decreased by 50 percent after 2 weeks. The non-sporeforming bacteria were reduced by 80 percent after 2 weeks and by 90 percent after 8 weeks. The aerobic sporeformers, molds, and actinomycetes were reduced only by 20 percent within 8 weeks.

In another series of tests, sterile stainless strips were contaminated by handling, placed in sterile containers and assayed at intervals up to 4 weeks. After 2 weeks less than 10 percent of the microbial population survived. After 4 weeks of sterile storage, approximately 1 to 2 percent of the population survived.

3. The design of an experimental system for determining the recovery of viable microorganisms from solids was initiated. Solid pellets of a dental inlay material containing a known number of spores of Bacillus subtilis var. niger were ground by mortar and pestle, recovered in a liquid menstruum, and plated in trypticase soy agar. Preliminary results show that the methods of grinding and the type of recovery menstruum can affect the recovery of viable microorganisms. When the pellets were ground in the presence of a liquid menstruum, the percent of recovery was twice that when dry grinding was used. Preliminary data also suggest that when sterile eugon broth is used as the recovery menstruum more organisms are recovered than when sterile phosphate buffer is used. Other studies showed that acetone and benzene could be used as carriers of bacterial spores in future experimental systems using plastics.